

TENTATIVE

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15.0"XGA

TECHNICAL SPECIFICATION

AA150XR01

MITSUBISHI ELECTRIC Corp.

Date: Sep.25, '07

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1. APPLICATION

This specification applies to color TFT-LCD module, AA150XR01.

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MITSUBISHI classifies the usage of the TFT-LCD module as follows. Please confirm the usage before using the product.

(1) Standard Usage

Computers, office equipment, factory automation equipment, test and measurement equipment, communications, transportation equipment(automobiles, ships, trains, etc.), provided, however, that operation is not influenced by TFT-LCD directly.

(2) Special Usage

Medical equipment, safety equipment, transportation equipment, provided, however, that TFT-LCD is necessary to its operation.

(3) Specific Usage

Cockpit Equipment, military systems, aerospace equipment, nuclear reactor control systems, life support systems and any other equipment. MITSUBISHI should make a contract that stipulate apportionment of responsibilities between MITSUBISHI and our customer.

The product specified in this document is designed for "Standard Usage" unless otherwise specified in this document. If customers intend to use the product for applications other than those specified for "Standard Usage", they should first contact MITSUBISHI sales representative for it's intended use in writing.

MITSUBISHI has been making continuous effort to improve the reliability of its products. Customers should implement sufficient reliability design of their application equipments such as redundant system design, fail-safe functions, anti-failure features.

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Please contact and consult a MITSUBISHI sales representative for any questions regarding this product.



2. OVERVIEW

 $AA150XR01 \ \ is \ 15.0" \ \ color \ \ TFT-LCD \ \ (Thin \ \ Film \ \ Transistor \ \ Liquid \ \ Crystal \ \ Display) \ \ modules composed of LCD panel, driver ICs, control circuit, and backlight unit.$

By applying 6 bit or 8 bit digital data, 1024×768 , 262k-color or 16.7M-color images are displayed on the 15.0" diagonal screen. Input power voltage is 3.3 V for LCD driving.

The type of data and control signals are digital and transmitted via LVDS interface per Typ. 65 MHz clock cycle.

Inverter for backlight is not included in this module. General specifications are summarized in the following table:

ITEM	SPECIFICATION
Display Area (mm)	304.1 (H) × 228.1 (V) (15.0-inch diagonal)
Number of Dots	$1024 \times 3 \text{ (H)} \times 768 \text{ (V)}$
Pixel Pitch (mm)	$0.297 \text{ (H)} \times 0.297 \text{ (V)}$
Color Pixel Arrangement	RGB vertical stripe
Display Mode	Normally white TN
Number of Color	262k(6 bit/color) 16.7M(8 bit/color)
Luminance (cd/m²)	1500
Wide Viewing Angle Technology	Optical Compensation Film
Viewing Angle (CR ≥ 10)	-70~70° (H) −60~50° (V)
Surface Treatment	Anti-glare and hard-coating 3H
Electrical Interface	LVDS (6 bit/8 bit)
Optimum Viewing Angle (Contrast ratio)	6 o'clock
Module Size (mm)	326.0 (W) × 267.0 (H) × 20.5 (D)
Module Mass (g)	1900
Backlight Unit	CCFL, 6 -tubes, edge-light, replaceable

Characteristic value without any note is typical value.



3. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MIN. MAX.				
Power Supply Voltage for LCD	VCC	0	4.0	V			
Logic Input Voltage	VI	-0.3	VCC+0.3	V			
Lamp Voltage	VL	0	2500	Vrms			
Lamp Current	IL	0	10.0	mArms			
Lamp Frequency	FL		100	kHz			
Operation Temperature (Panel) Note 1,3	Top(Panel)	-20	70	°C			
Operation Temperature (Ambient) Note 2)	Top(Ambient)	-20	70	°C			
Storage Temperature Note 2)	T _{stg}	-20	80	°C			

[Note]

- 1) Measured at the center of active area and at the center of panel back surface $\frac{1}{2}$
- 2) Top,Tstg \leq 40°C : 90%RH max. without condensation Top,Tstg > 40°C : Absolute humidity shall be less than the value of 90%RH at 40°C without condensation.

4. ELECTRICAL CHARACTERISTICS

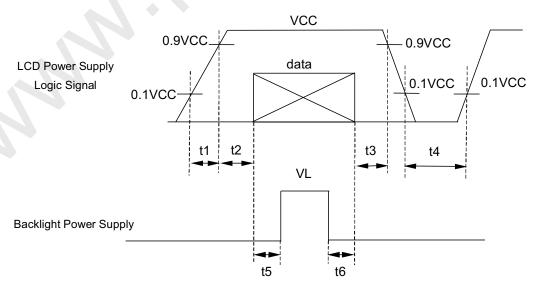
(1) TFT- LCD

Ambient Temperature : Ta = 25°C

ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	Remarks
Power Supply Voltage	VCC	3.0	3.3	3.6	V	*1)	
Power Supply Currer	ICC		410	700	mA	*2), *3)	
Permissive Input Rip	Permissive Input Ripple Voltage				100	mVp-p	VCC = +3.3 V
Logic Input Voltage	High	VIH	2.0		VCC+0.3	V	MODE, SC
Logic Input Voltage	Low	VIL	0		0.8	V	MODE, SC

*1) Power and signals sequence:

 $t1 \le 10 \text{ ms}$ $0 < t2 \le 50 \text{ ms}$ $0 < t3 \le 50 \text{ ms}$ 200 ms \leq t4 200 ms \leq t5 0 \leq t6



data: RGB DATA, DCLK, DENA, MODE, SC

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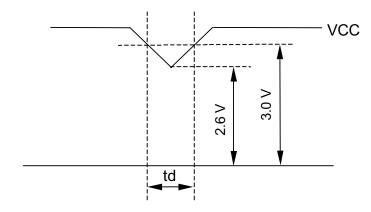
(5/25)



VCC-dip conditions:

- 1) When $2.6 \text{ V} \le \text{VCC} < 3.0 \text{ V}$, $\text{td} \le 10 \text{ ms}$
- 2) When VCC < 2.6 V

 $VCC\mbox{-}dip$ conditions should also follow the power and signals sequence.



*2) Typical current condition:

64-gray-bar-pattern(6 bit)

256-gray-bar-pattern(8 bit)

768 line mode

 $VCC = +3.3 \text{ V}, f_H = 48.4 \text{ kHz}, f_V = 60 \text{ Hz}, f_{CLK} = 65 \text{ MHz}$

*3) Fuse

Parameter	Fuse Type Name	Supplier	Rating	Fusing Current	Remark
VCC	FHC16322AD	Kamaya Electric	24 [V]	7.88 [A]	*)
I VCC	FIICIUSZZAD	Co., Ltd.	3.15 [A]	7.00 [A]	,

 $[\]ensuremath{^*}\xspace$) The power supply capacity should be designed to be more than the fusing current.

(2) Backlight

I	a	=	23	

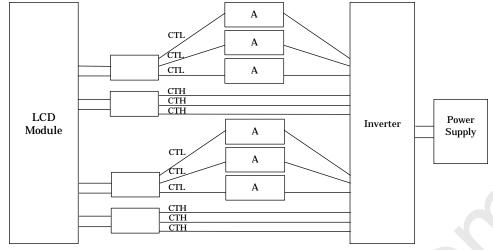
(1) = 1111110						
ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	Remarks
Lamp Voltage	VL	<u></u>	620		Vrms	IL = 6.5 mArms
Lamp Current	IL	3.5	6.5	7.5	mArms	*2),*6)
Lamp Frequency	FL	40		70	kHz	*3)
		1300			Vrms	Ta = 25°C
Starting Lamp Voltage	VS	1500			Vrms	Ta = 0°C
		1650			Vrms	Ta = -20°C
Lamp Life Time	LT	50000			h	*4),*5) IL = 6.5 mArms, Continuous Operation

^{*1)} Please use synchronous inverter.

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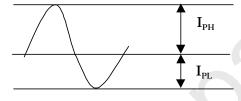
*2) Lamp Current measurement method (The current meter is inserted in low voltage line.)



- *3) Lamp frequency of inverter may produce interference with horizontal synchronous frequency, and this may cause horizontal beat on the display. Therefore, please adjust lamp frequency, and keep inverter as far from module as possible or use electronic shielding between inverter and module to avoid the interference.
- *4) Lamp life time is defined as the time either when the brightness becomes 50% of the initial value, or when the starting lamp voltage does not meet the value specified in this table.
- *5) The life time of the backlight depends on the ambient temperature. The life time will decrease under low/high temperature.
- *6) Please use the inverter which has symmetrical current wave form as follows,

The degree of unbalance: less than 10%

The ratio of wave height: less than $\sqrt{2} \pm 10\%$



 I_{PH} : High side peak

 $I_{\text{PL}}\!\!:$ Low side peak

The degree of unbalance = $\mid I_{PH}$ - $I_{PL} \mid$ / Irms \times 100(%) The ratio of wave height = $I_{PH}(or~I_{PL})$ / Irms

CURRENT WAVE FORM



5. INTERFACE PIN CONNECTION

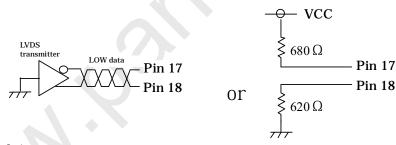
(1) CN 1(Interface Signal)

Used Connector: DF14H-20P-1.25H(56) (HIROSE) Corresponding connector: DF14-20S-1.25C (HIROSE)

Pin	Symbol	Function(ISP 6 bit o	compatibility mode)	Function(ISP 8 bit					
No.	Symbol	6 bit input	8 bit input	compatibility mode)					
1	VCC	+3.3 V Pov	wer supply	←					
2	VCC	+3.3 V Pov	wer supply	←					
3	GND	Gl	ND	←					
4	GND	GI	ND	\leftarrow					
5	Link 0-	R0, R1, R2, R3, R4, R5, G0	R2, R3, R4, R5, R6, R7, G2	R0, R1, R2, R3, R4, R5, G0					
6	Link 0+	R0, R1, R2, R3, R4, R5, G0	R2, R3, R4, R5, R6, R7, G2	R0, R1, R2, R3, R4, R5, G0					
7	GND	GI	ND	←					
8	Link 1-	G1, G2, G3, G4, G5, B0, B1	G3, G4, G5, G6, G7, B2, B3	G1, G2, G3, G4, G5, B0, B1					
9	Link 1+	G1, G2, G3, G4, G5, B0, B1	G3, G4, G5, G6, G7, B2, B3	G1, G2, G3, G4, G5, B0, B1					
10	GND	GI	ND	←					
11	Link 2-	B2, B3, B4, B5, DENA	B4, B5, B6, B7, DENA	B2, B3, B4, B5, DENA					
12	Link 2+	B2, B3, B4, B5, DENA	B4, B5, B6, B7, DENA	B2, B3, B4, B5, DENA					
13	GND	GI	ND	\leftarrow					
14	CLKIN-	Clo	ck –	\leftarrow					
15	CLKIN+	Clo	ck +	←					
16	GND	GI	ND	\leftarrow					
17	Link3-	See: *2)	R0, R1, G0, G1, B0, B1	R6, R7, G6, G7, B6, B7					
18	Link3+	See: *2)	R0, R1, G0, G1, B0, B1	R6, R7, G6, G7, B6, B7					
19	MODE	Low=ISP 6 bit c	ompatibility mode	High=ISP					
19	MODE	LUW=13F 6 DILC	ompationity mode	8 bit compatibility mode					
20	SC	Scan direction control (Low	= Normal , High = Reverse)	\leftarrow					

^{*1)} The shielding case is connected with GND

^{*2)} Recommended wiring of Pin 17,18 (6 bit input)



(2) CN 2,4(Backlight)

Backlight-side connector: BHR-03(6.0)VS-1 (JST)

Inverter-side connector: SM03B-BHS-1R-TB(LF)(SN) (JST)

Pin No.	Symbol	Function
1, 2, 3	СТН	VBLH (High Voltage)

[Note]

VBLH-VBLL = VL

(3) CN 3,5(Backlight)

Backlight-side connector: BHR-03VS-1 (JST)

Inverter-side connector: SM03(4.0)B-BHS-1-TB(LF)(SN) (JST)

Pin No.	Symbol	Function
1, 2, 3	CTL	VBLL (Low Voltage)

[Note]

VBLH-VBLL = VL

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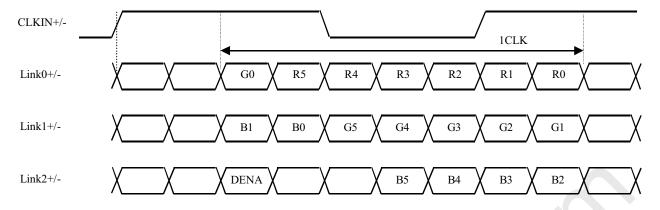
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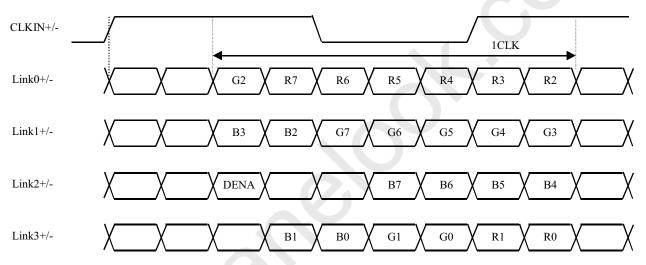


(4) ISP data mapping

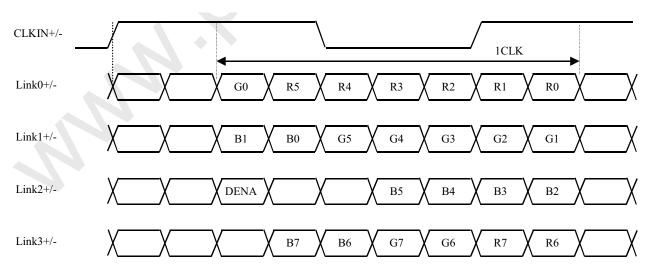
a. ISP 6 bit compatibility $mode(6 \ bit \ input)$



b. ISP 6 bit compatibility mode(8 bit input)



c. ISP 8 bit compatibility mode $\,$



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6. INTERFACE TIMING

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LVDS transmitter input signal

(1) Timing Specifications

ITEM			SYMBOL	MIN.	TYP.	MAX.	UNIT
D.CL IV	Frequency		fclk	50	65	80	MHz
DCLK	Period		tclk	12.5	15.4	20	ns
		Active Time	tha	1024	1024	1024	tclk
	TT 1	Blanking Time	tнв	20	320		tclk
	Horizontal	Frequency	fн	42.4	48.4	60	kHz
D = 1.14		Period	tн	16.6	20.7	23.6	μs
DENA		Active Time	tva	768	768	768	tн
	Vertical	Blanking Time	tvв	3	38		tн
	vertical	Frequency	fv	55	60	75	Hz
		Period	tv	13.3	16.7	18.2	ms

[Note]

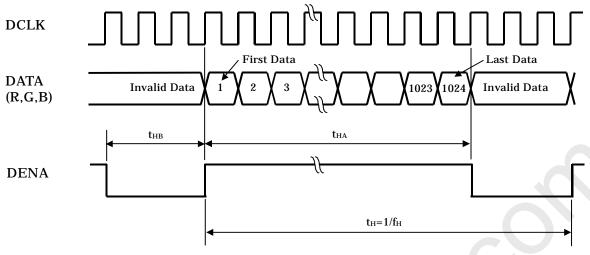
- 1) DENA (Data Enable) shall always be positive polarity as shown in the timing specification.
- 2) DCLK shall appear during all invalid period.
- 3) LVDS timing follows the timing specifications of LVDS receiver IC: THC63LVDF84B(Thine).
- 4) In case of blanking time fluctuation, please satisfy following condition.

$$t_{VBn} > t_{VBn-1} - 3(t_H)$$

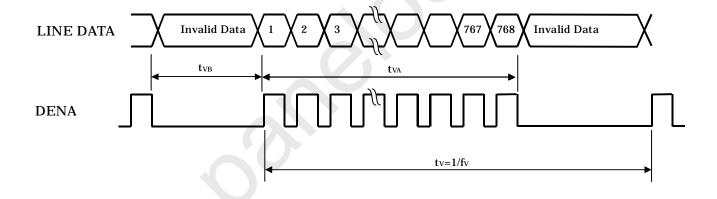
(2) Timing Chart

a. Horizontal Timing Chart

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b. Vertical Timing Chart





(3) Color Data Assignment

[Note]

1) Definition of gray scale

BLUE(63)

Color (n) ---n indicates gray scale level.

Higher n means brighter level.

2) Data

1:High, 0: Low

b. 8 bit input

D. O DIL I	<u>mput</u>																								
												INI	PUT	DA	TA										
CC	OLOR			I	R D	ΑТА				G DATA							B DATA								
	JLON	R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	В7	В6	В5	В4	В3	В2	В1	В0
		MSB							LSB	MSB							LSB	MSB							LSB
	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
BASIC	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
COLOR	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	RED(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
																					<u>.</u>			<u></u>	
RED																						ļ	<u></u>	<u></u>	
									<u>.</u>												ļ			<u></u>	
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
CDEEN																					ļ			ļ	
GREEN			<u> </u>	ļ																	ļ		ļ	ļ	
			<u> </u>								ļ									ļ	ļ	ļ	ļ	ļ	
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	BLUE(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
DITTE											ļ						ļ			ļ	ļ	ļ	<u> </u>	<u></u>	
BLUE											ļ		ļ							<u></u>	<u></u>			<u></u>	
											ļ		ļ							ļ	ļ			ļ	
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

[Note]

1) Definition of gray scale

Color (n) --- n indicates gray scale level. Higher n means brighter level.

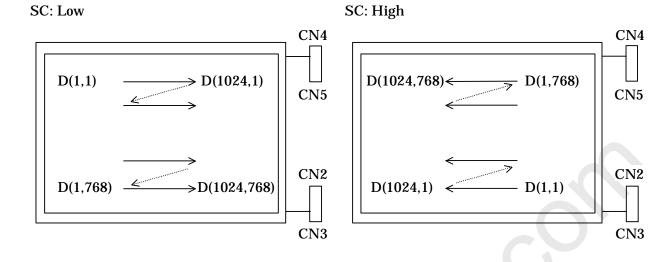
2) Data

1:High, 0: Low



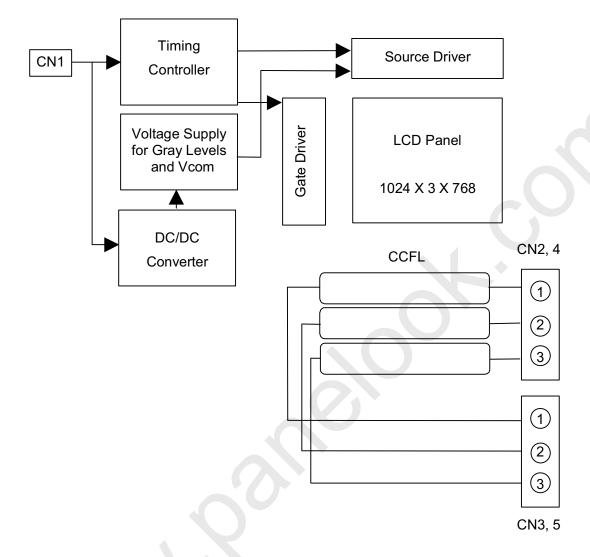
(4) Display Position and Scan Direction

D(X,Y) shows the data number of input signal for LCD panel signal processing PCB.



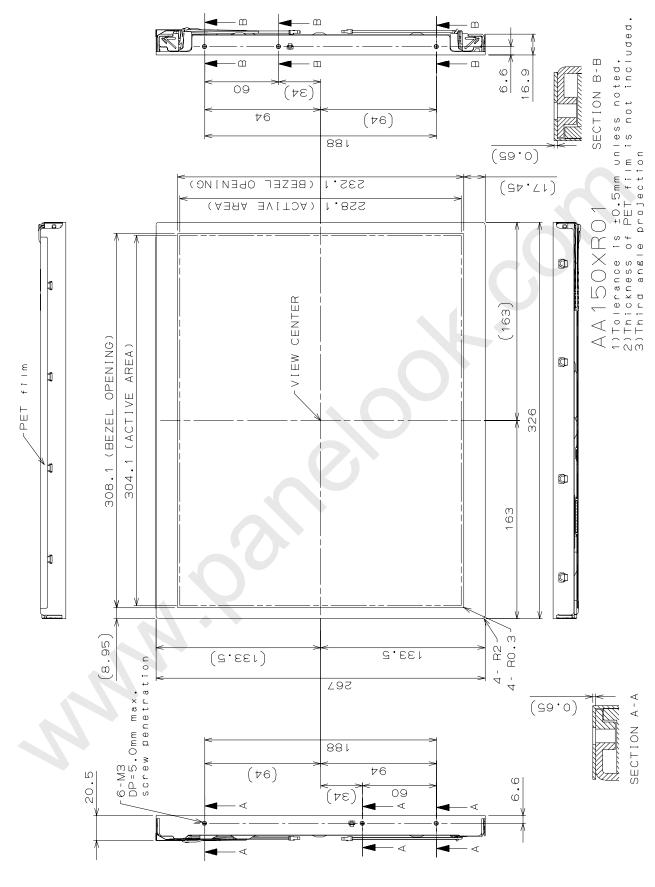


7. BLOCK DIAGRAM



8. MECHANICAL SPECIFICATIONS

(1) Front side



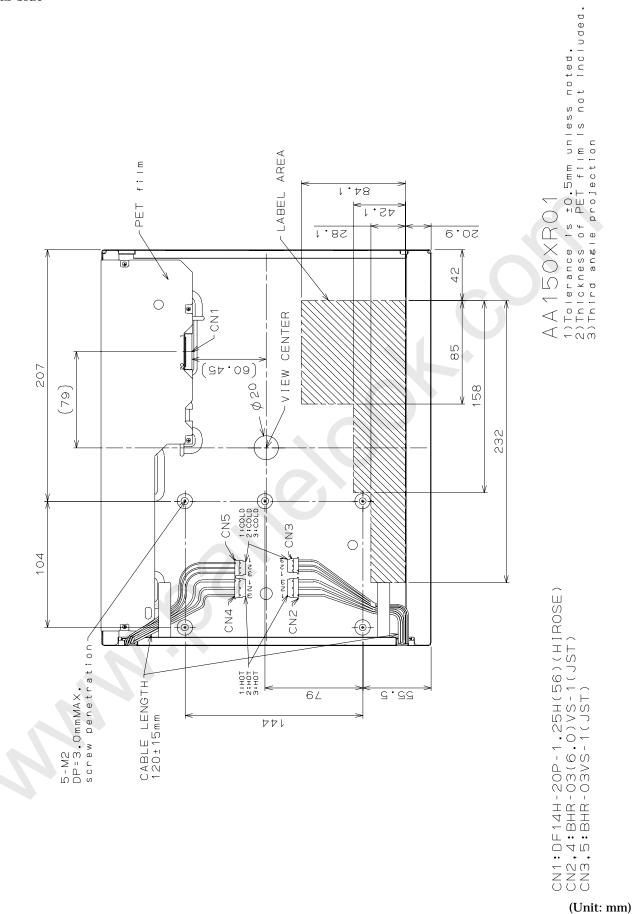
(Unit: mm)

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(2) Rear side

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9. OPTICAL CHARACTERISTICS

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Ta = 25°C, VCC = 3.3 V, Input Signals: Typ. Values shown in Section 6

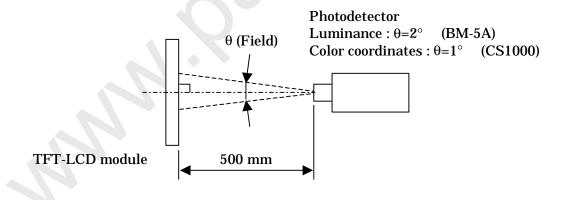
						<u> </u>		
ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	Remarks
Contrast Ratio		CR	$\theta_V=0^\circ,\theta_H=0^\circ$	420	650			*1)*2)*5)
Luminance		Lw	$\theta_V=0^\circ,\theta_H=0^\circ$	1200	1500		cd/m²	*1)*5)
Luminance Uniformity		ΔLw	$\theta_V=0^\circ, \theta_H=0^\circ$			30	%	*1)*3)*5)
Response Time		tr	$\theta_V=0^\circ, \theta_H=0^\circ$		6		ms	*1)*4)*5)
		tf	$\theta_V=0^\circ, \theta_H=0^\circ$		19		ms	*1)*4)*5)
	Horizontal	θ_{H}	CR ≥ 10	-60~60	-70~70		٥	*1)*5)
Viewing	Vertical	$\theta_{ m V}$	CR ≥ 10	-50~40	-60~50		٥	*1)*5)
Angle	Horizontal	θн	CR≥5	-70~70	-80~80		۰	*1)*5)
	Vertical	θν		-70~50	-80~60		0	*1)*5)
Image Sticking		tis	2 h			2	S	*6)
	Red	Rx		0.579	0.609	0.639		
		Ry		0.316	0.346	0.376		
	Green	Gx		0.277	0.307	0.337		
Color		Gy		0.538	0.568	0.598		*1) *5)
Coordinates	Blue	Bx	$\theta_{V}=0^{\circ}, \theta_{H}=0^{\circ}$	0.121	0.151	0.181		1) '3)
		By		0.109	0.139	0.169		
	White	Wx		0.283	0.313	0.343		
		Wy		0.299	0.329	0.359		

[Note]

These items are measured using CS1000(MINOLTA) for color coordinates, EZContrast(ELDIM) for viewing angle, and CS1000 or BM-5A(TOPCON) for others under the dark room condition (no ambient light) after more than 30 minutes from turning on the lamp unless noted.

Condition: IL = 6.5 mArms, Inverter frequency: 55 kHz

Measurement method for luminance and color coordinates is as follows.

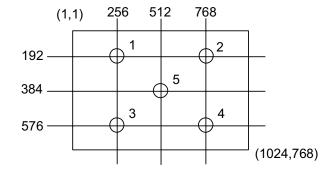


The luminance is measured according to FLAT PANEL DISPLAY MEASUREMENTS STANDARD (VESA Standard).

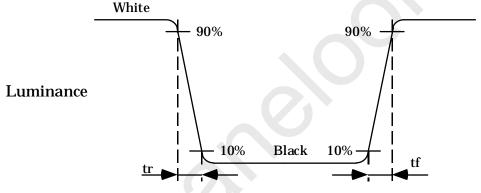


*1) Measurement Point

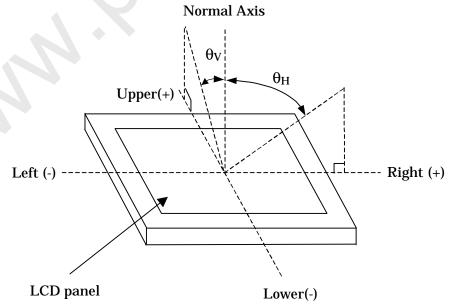
Contrast Ratio, Luminance, Response Time, Viewing Angle, Color Coordinates: Display Center Luminance Uniformity: point $1{\sim}5$ shown in a figure below



- *2) Definition of Contrast Ratio CR=Luminance with all white pixels / Luminance with all black pixels
- *3) Definition of Luminance Uniformity $\Delta Lw=[Lw(MAX)/Lw(MIN)-1]\times 100$
- *4) Definition of Response Time



*5) Definition of Viewing Angle (θ_V , θ_H)



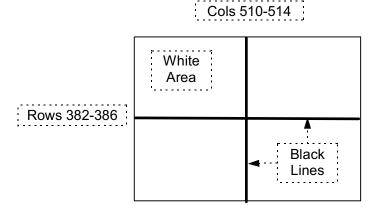
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*6) Image Sticking

Continuously display the test pattern shown in the figure below for two-hours. Then display a completely white screen. The previous image shall not persist more than two seconds at 25° C.



TEST PATTERN FOR IMAGE STICKING TEST



10. RELIABILITY TEST CONDITION

(1) Temperature and Humidity

ITEM	CONDITIONS			
HIGH TEMPERATURE	40°C, 90% RH, 240 h			
HIGH HUMIDITY OPERATION	(No condensation)			
HIGH TEMPERATURE OPERATION	70°C, 240 h			
LOW TEMPERATURE OPERATION	−20°C, 240 h			
HIGH TEMPERATURE STORAGE	80°C, 240 h			
LOW TEMPERATURE STORAGE	−20°C, 240 h			
THERMAL SHOCK (NON-OPERATION)	BETWEEN -20°C (1h) and 80°C(1h), 100 CYCLES			

(2) Shock & Vibration

(2) Shock & Vibration					
ITEM	CONDITIONS				
	Shock level: 980 m/s² (100 G)				
SHOCK	Waveform: half sinusoidal wave, 2 ms				
(NON-OPERATION)	Number of shocks: one shock input in each direction of three mutually				
	Perpendicular axes for a total of six shock inputs				
	Vibration level: 9.8 m/s² (1.0 G) zero to peak				
	Waveform: sinusoidal				
VIBRATION	Frequency range: 5 to 500 Hz				
(NON-OPERATION)	Frequency sweep rate: 0.5 octave /min				
	Duration: one sweep from 5 to 500 Hz in each of three mutually				
	perpendicular axis(each x,y,z axis: 1 hour, total 3 hours)				

(3) Judgment standard

The judgment of the above tests should be made as follow:

Pass: Normal display image, no damage of the display function. (ex. no line defect)

Partial transformation of the module parts should be ignored.

Fail: No display image, damage of the display function. (ex. line defect)



11. OTHER FEATURE

This LCD module complies with RoHS*) directive.

*) RoHS: Restriction of the use of certain hazardous substances in electrical and electronic equipment

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Please pay attention to the followings in handling TFT-LCD products;

(1) ASSEMBLY PRECAUTION

- a. Please mount the LCD module by using mounting hole with a screw clamping torque less than 0.5 Nm. Please do not bend or wrench the LCD module in assembling. Please do not drop, bend or twist the LCD module in handling. Please mount the inverter circuit board by using mounting hole of rear side with a screw clamping torque less than 0.2 Nm.
- b. Please design display housing in accordance with the following guide lines.
 - (a) Housing case must be designed carefully so as not to put stresses on LCD all sides and not to wrench module. The stresses may cause non-uniformity even if there is no non-uniformity statically.
 - (b) Keep sufficient clearance between LCD module back surface and housing when the LCD module is mounted. Approximately 1.0mm of the clearance in the design is recommended taking into account the tolerance of LCD module thickness and mounting structure height on the housing.
 - (c) When some parts, such as, FPC cable and ferrite plate, are installed underneath the LCD module, still sufficient clearance is required, such as 0.5mm. This clearance is, especially, to be reconsidered when the additional parts are implemented for EMI countermeasure.
 - (d) Design the inverter location and connector position carefully so as not to give stress to lamp cable, or not to interface the LCD module by the lamp cable.
 - (e) Keep sufficient clearance between LCD module and the others parts, such as inverter and speaker so as not to interface the LCD module. Approximately 1.0mm of the clearance in the design is recommended.
 - (f) To avoid local elevation/decrease of temperature, considering location of heating element, heat release, thermal design should be done.
- c. Please do not push or scratch LCD panel surface with anything hard. And do not soil LCD panel surface by touching with bare hands. (Polarizer film, surface of LCD panel is easy to be flawed.)
- d. Please do not press any parts on the rear side such as source TCP, gate TCP, control circuit board and FPCs during handling LCD module. If pressing rear part is unavoidable, handle the LCD module with care not to damage them.
- e. Please wipe off LCD panel surface with absorbent cotton or soft cloth in case of it being soiled.
- f. Please wipe off drops of adhesives like saliva and water on LCD panel surface immediately. They might damage to cause panel surface variation and color change.
- g. Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.
- h. Please do not touch metal frames with bare hands and soiled gloves. A color change of the metal frames can happen during a long preservation of soiled LCD modules.
- i. Please handle metal frame carefully because edge of metal frame is very sharp.
- j. Please pay attention to handling lead wire of backlight so that it is not tugged in connecting with inverter.

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- k. Please connect the metal frame of LCD module to GND in order to minimize the effect of external noise and EMI.
- l. Be sure to connect the cables and the connectors correctly.

(2) OPERATING PRECAUTIONS

- a. Please be sure to turn off the power supply before connecting and disconnecting signal input cable.
- b. Please do not change variable resistance settings in LCD module. They are adjusted to the most suitable value. If they are changed, it might happen LCD does not satisfy the characteristics specification.
- c. LCD backlight takes longer time to become stable of radiation characteristics in low temperature than in room temperature.
- d. The interface signal speed is very high. Please pay attention to transmission line design and other high speed signal precautions to satisfy signal specification.
- e. A condensation might happen on the surface and inside of LCD module in case of sudden change of ambient temperature.
- f. Please pay attention not to display the same pattern for very long time. Image might stick on LCD. Even if image sticking happens, it may disappear as the operation time proceeds.
- g. Please obey the same safe instructions as ones being prepared for ordinary electronic products.

(3) PRECAUTIONS WITH ELECTROSTATICS

- a. This LCD module use CMOS-IC on circuit board and TFT-LCD panel, and so it is easy to be affected by electrostatics. Please be careful with electrostatics by the way of your body connecting to the ground and so on.
- b. Please remove protection film very slowly from the surface of LCD module to prevent from electrostatics occurrence.

(4) STORAGE PRECAUTIONS

- a. Please do not leave the LCDs in the environment of high humidity and high temperature such as 60°C90% RH.
- b. Please do not leave the LCDs in the environment of low temperature; below -20°C.

(5) SAFETY PRECAUTIONS

- a. When you waste damaged or unnecessary LCDs, it is recommended to crush LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
- b. If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.
- c. Be sure to turn off the power supply when inserting or disconnecting the cable.
- d. Inverter should be designed carefully so as not to keep working in case of detecting over current



or open circuit on the lamp.

(6) OTHERS

- a. A strong incident light into LCD panel might cause display characteristics changing inferior because of polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight and strong UV rays.
- b. Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.
- c. For the packaging box, please pay attention to the followings;
 - (a) Packaging box and inner case for LCD are designed to protect the LCDs from the damage or scratching during transportation. Please do not open except picking LCDs up from the box.
 - (b) Please do not pile them up more than 6 boxes. (They are not designed so.) And please do not turn over.
 - (c) Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
 - (d) Packaging box and inner case for LCDs are made of cardboard. So please pay attention not to get them wet. (Such like keeping them in high humidity or wet place can occur getting them wet.)